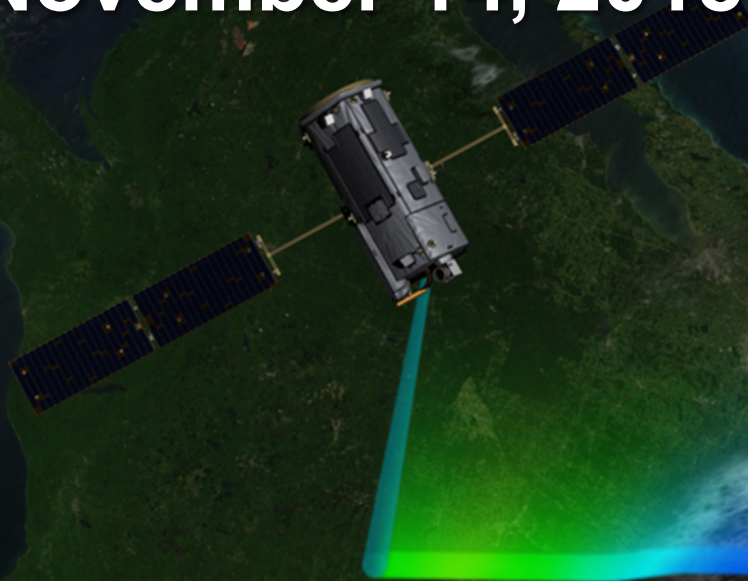


OCO-2 Status November 14, 2018



David Crisp, for the OCO-2 Team

Jet Propulsion Laboratory, California Institute of Technology

November 14, 2018

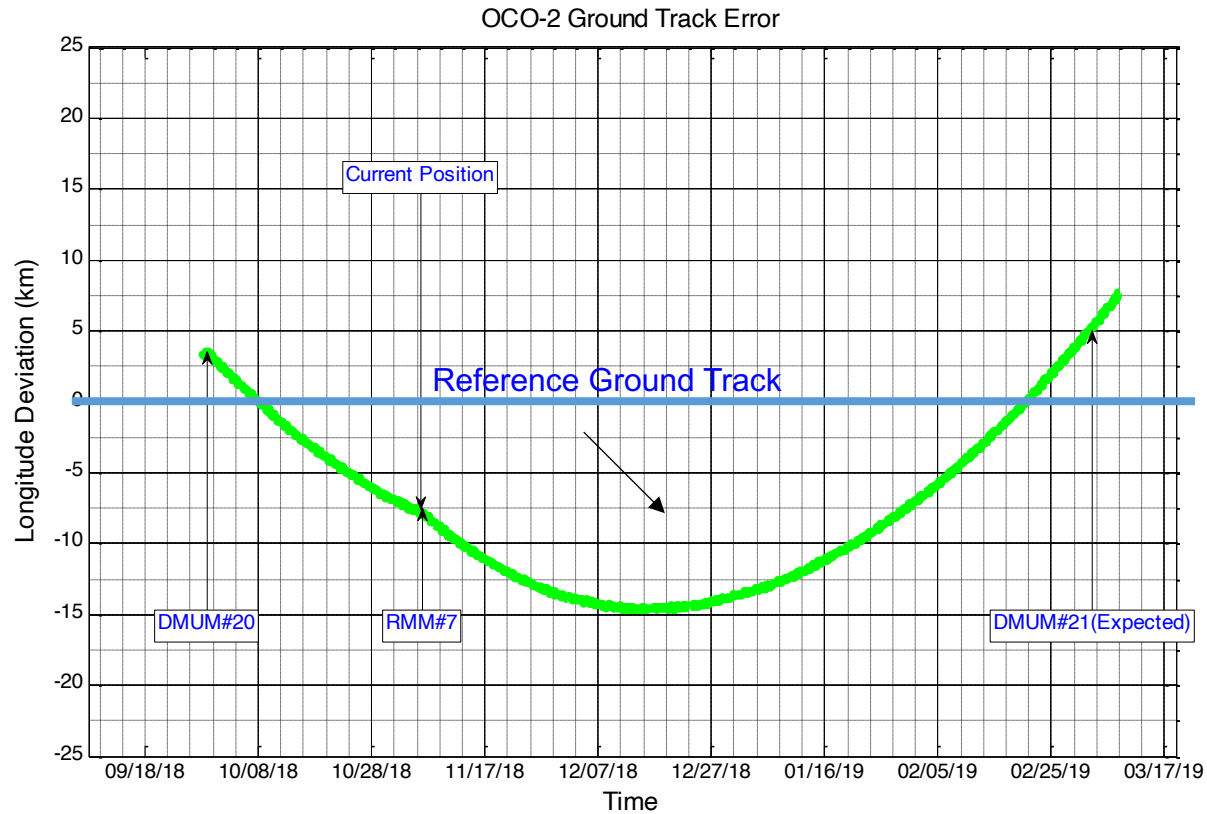


Status Summary

- Observatory Status: **Nominal**
 - On 5 November, OCO-2 executed its 7th Risk Mitigation Maneuver (RMM#7)
 - This is the first RMM since 3 March 2016
- Instrument Status: **Off-line for Decontamination Cycle 11**
 - Decon start: November 10th, 2018, Orbit 23187
 - Decon stop (estimated): November 17th, 2018, Orbit TBD
- Science Status: **Nominal**
 - “Version 9” Lite file updates (geolocation, met re-sampler fix)
 - ACOS/GOSAT version 9, slowly coming together
- Railroad Valley Status



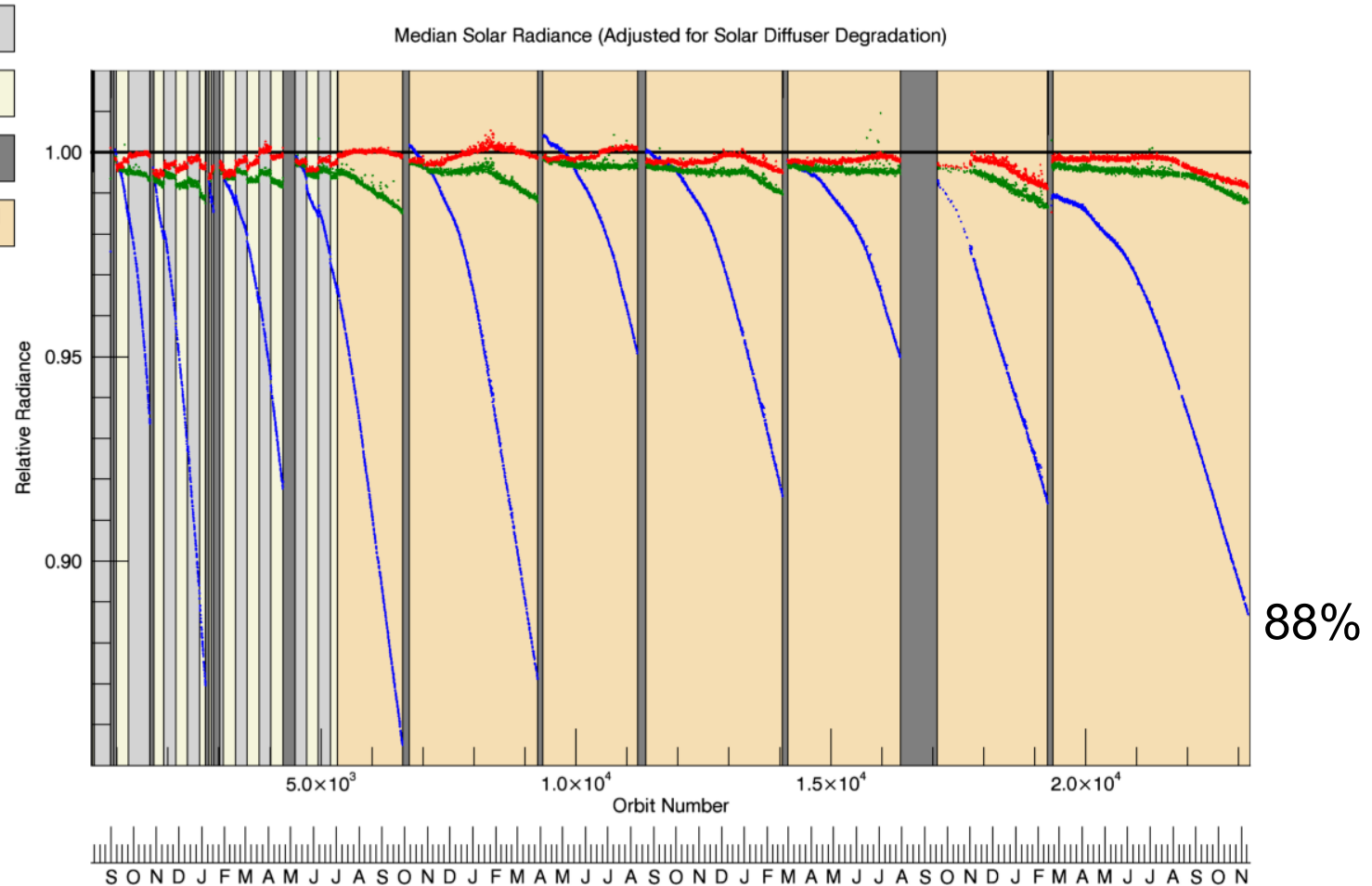
OCO-2 Ground Track



The Risk Mitigation Maneuver on 5 November produced a small change in the predicted OCO-2 ephemeris. The next Drag Makeup Maneuver is tentatively scheduled for 3 March 2019.



Contamination Trending

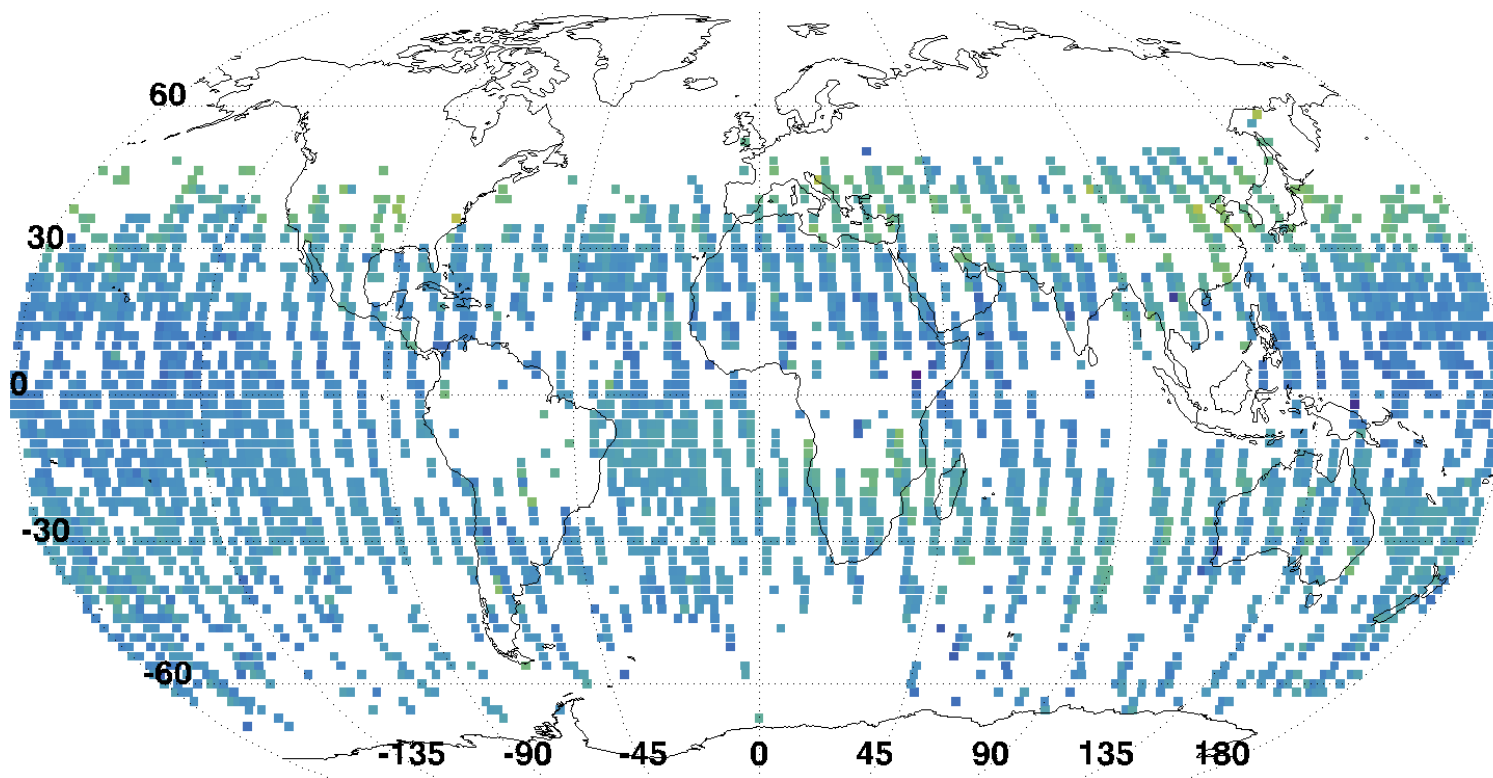


Decon Cycle #11 initiated on 10 Nov (Orbit 23187) when A-Band throughput was at ~88%



November X_{CO_2} (V8 forward stream)

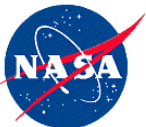
Mean X_{CO_2} - Nov 2018



Mean X_{CO_2} (ppm)



12 Nov 2018
Ops_B8100_r0x



The OCO-2 V9 Product

- The OCO-2 Team released the Version 9 (V9) product on 10/15.

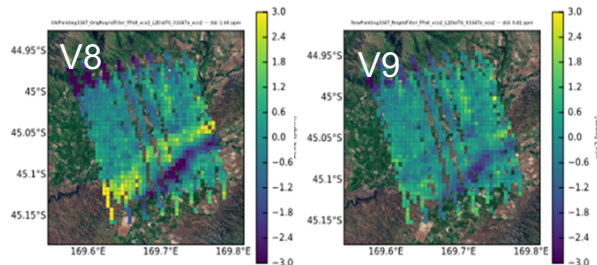
- refined pointing
- a correction to the prior meteorology
- updated filtering and bias correction

- These updates

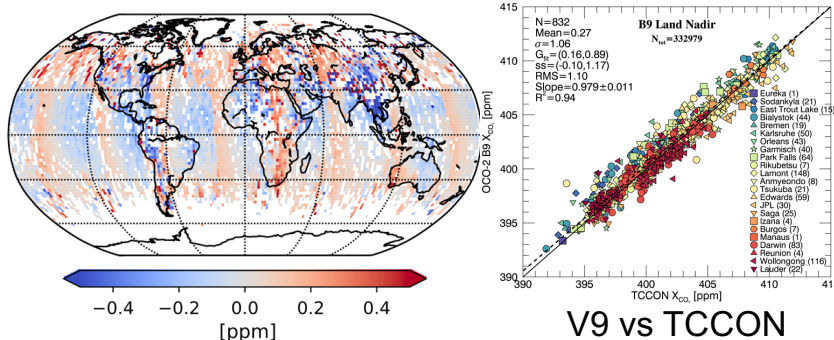
- reduce bias in the presence of rough topography
- Provide better sampling over tropical and boreal forests with slightly more scatter

- This new dataset is available through the GES-DISC

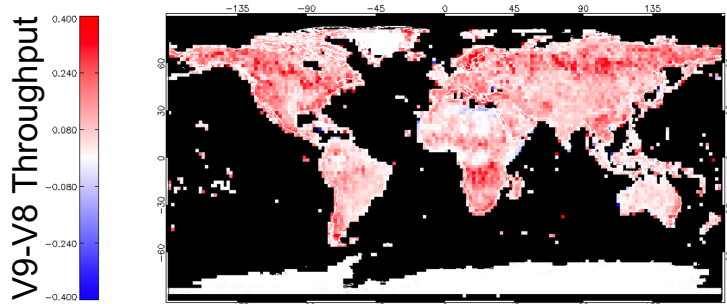
<https://disc.gsfc.nasa.gov/datasets?keywords=oco-2&page=1>



Pointing Correction Reduces XCO₂ Bias



XCO₂ Differences: V8 - V9



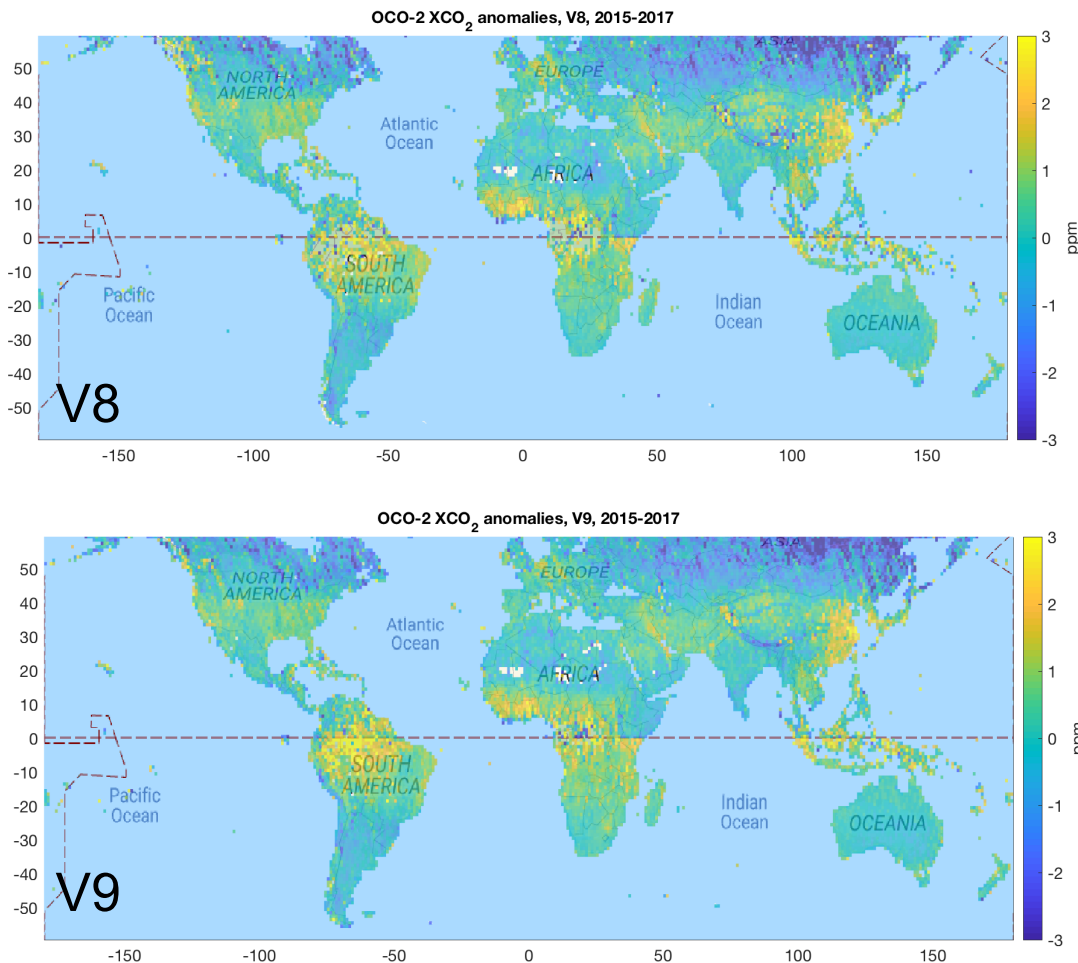
Improved Coverage over Tropical and Boreal Forests



Persistent X_{CO_2} Anomalies

Comparison of the V8 and V9 Products

- OCO-2 X_{CO_2} estimates are being used to look for persistent anomalies associated with CO₂ emissions (sources) and uptake (sinks) from human activities and the natural carbon cycle
- The X_{CO_2} anomalies identified in the version 8 (V8) product (top) is compared to those from the recently delivered V9 product (bottom)
- While the patterns are similar, the V9 product has much less scatter than v8, especially in areas with rough topography (i.e. Himalayas, Canadian Rockies)



Hakkarainen et al., press, 2018 (Finnish Meteorological Institute)





The Ongoing Battle for Railroad Valley

- **Relevance:** Earth Science Missions use the large, homogeneous Railroad Valley playa (RRV) for vicarious radiometric calibration of passive optical instruments
 - RRV is well characterized and instrumented and its surface is ideal for quantitative calibration traceable to international standards as well as for cross-instrument calibration
 - Railroad Valley, NV, is the only site in the U.S. that is homogeneous over a large enough area to accommodate large-footprint sensors, such as OCO-2, OCO-3, GOSAT, GOSAT-2, Sentinel 5p, and GeoCarb and for cross-calibration of these instruments with reference instruments, such as MODIS
- **Problem:** Mining claims threaten to disrupt the playa floor, rendering this critical asset useless for large footprint instruments
 - Railroad Valley is under the jurisdiction of the Bureau of Land Management and currently available for multiple uses
- **Objective:** Withdrawal application to preserve Railroad Valley
 - To preserve Railroad Valley in its natural state, the OCO-2 team is working with NASA HQ to prepare a “withdrawal application” to preclude the mining a



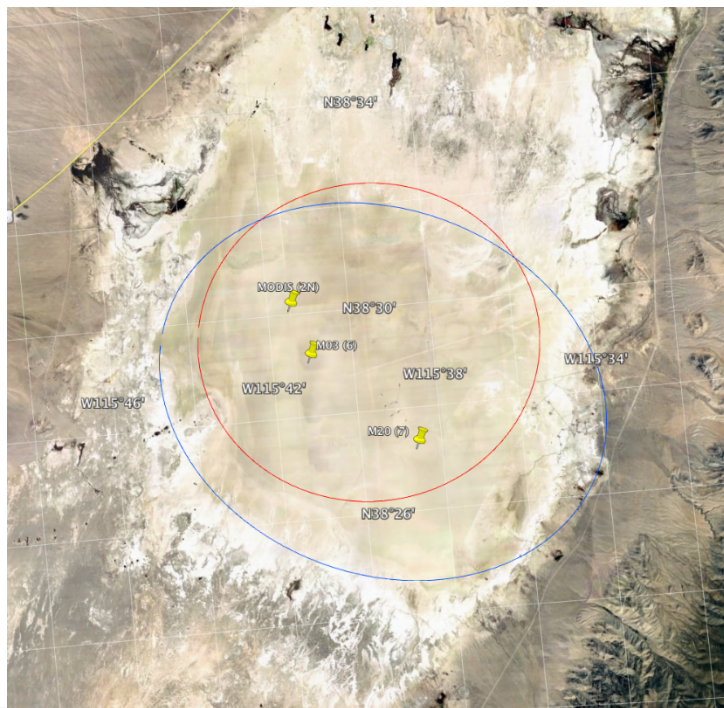
GOSAT/OCO experiments

- The OCO/GOSAT programs are examples of large footprint sensors that have been using RRV since 2009
- NASA Orbiting Carbon Observatory (OCO) and Japanese Greenhouse gases Observing SATellite (GOSAT) teams formed a close partnership to cross-calibrate their measurements and cross-validate their products
 - Missions include OCO-2 (2014), OCO-3 (Feb. 2019), GOSAT (2009) and GOSAT-2 (Oct. 2018)
 - All four missions require unprecedented calibration accuracy to meet their demanding (0.3%) data product accuracy requirements
 - Many of their science goals can only be addressed by combining data from all four missions, to produce a harmonized, continuous climate data record that spans the lifetimes of both missions
- Cross-calibration methods pioneered by the OCO/GOSAT collaboration have been adopted as best practice for cross-calibrating atmospheric composition sensors by the CEOS Atmospheric Composition-Virtual Constellation (AC-VC)



Withdrawal request suitable for AC-VC needs

NASA requests the dry lakebed playa at Railroad Valley (RRV), Nevada, be withdrawn and preserved in its current state so that it can continue to be used for the routine calibration and validation of Earth observation instruments flown by NASA and its partners. The subject area of NASA's withdrawal request is an approximately 43,000-acre flat playa.

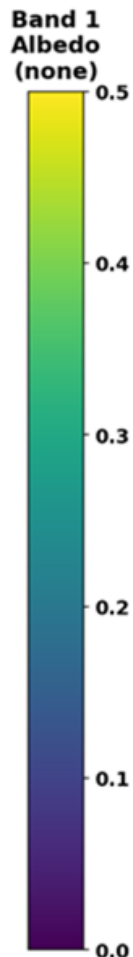
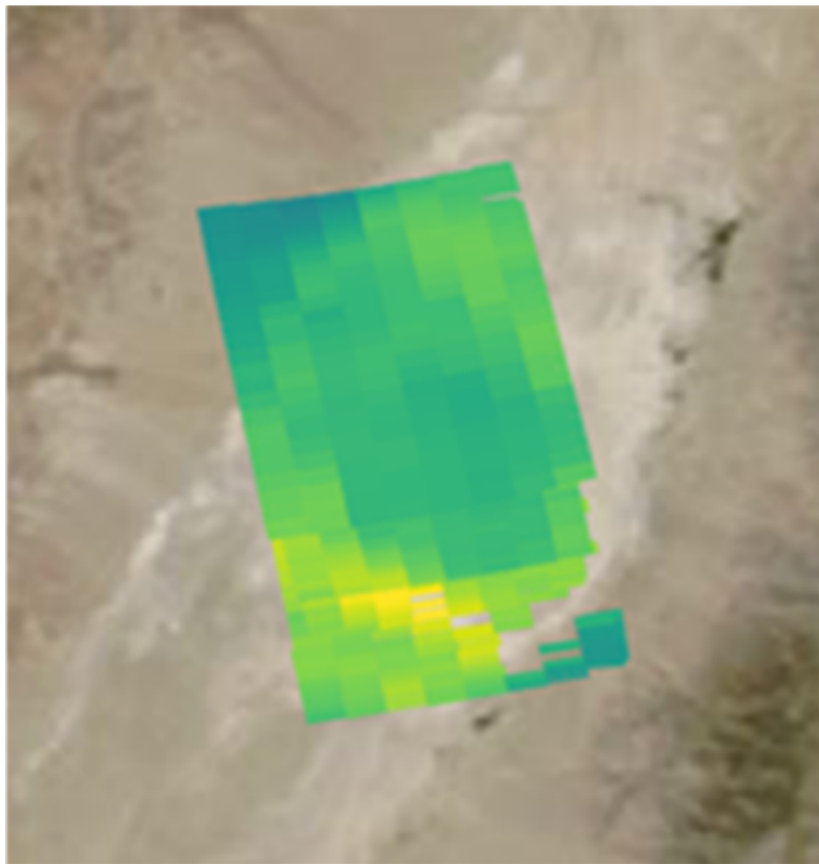


Exclusion zone has been prepared using GOSAT footprints.

Legend: Blue ellipse is GOSAT view from West; Red ellipse is GOSAT view from East. Yellow pins are current NASA network sites, in support of calibration activities, and under a BLM right-of-way agreement.



OCO-2 Calibration in Railroad Valley



- When OCO-2 targets RRV, it collects hundreds of measurements across the valley floor to cross-calibrate the eight footprints
- To meet this requirement, the area needed is comparable to that needed for GOSAT (~43k acres)
- This area is also needed to cross-calibrate OCO-2 and GOSAT

OCO-2 Oxygen A-band albedo measurements collected over Railroad Valley, Nevada by OCO-2 on June 30, 2018, during the 10th Annual Railroad Valley Vicarious Calibration Campaign.



Conclusions

- The Railroad Valley playa is a critical surface calibration site for several operating and planned Earth Science missions by NASA and its partners.
- It is the only site within the U.S. that is sufficiently homogeneous and undisturbed over a large enough area to enable vicarious calibration of large-footprint instruments, such as OCO-2 and OCO-3.
- Recent mining claims threaten to render Railroad Valley playa useless. We therefore need to apply for withdrawal of this land from BLM for exclusive NASA use.